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## Animal Communication: He's Giving Me Good Vibrations

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**A unique bioassay allows a substrate-borne vibration signal to be isolated and manipulated to test its role in eliciting female mate choice, which may be driving a speciation event, by a live, unrestrained male.**

The study of animal communication via substrate-borne vibrations, or what we now call *tremology* or *biotremology* [1], is an emerging field of animal communication that has shown tremendous growth in number of publications in the last 25 years [2]. What makes this growth trajectory so implausible is the certainty that this communication mode is both ancient (at least 230 million years old in insects [3]) and widely used in arthropods and vertebrates in multiple contexts [4–6]. Indeed, communication using vibrations and chemicals probably evolved with the early Metazoa [1]. Yet, the existence of vibrational communication in animals is virtually unknown to most non-scientists and not well-known even to many who specialize in acoustic communication, which includes use of both airborne (sound) and substrate-borne vibration signals.

Bees, in general, are thought to be most influenced by chemical signals, but honey bees produce low-frequency substrate-borne vibrations in the honeycomb as they dance. Vibrations of thoracic flight

muscle without actual wing movement are transferred to the comb by honey bees pressing their bodies against the substrate [7]. Bumblebees and stingless bees produce these thoracic vibrations [8], as do some groups of flies [5]. Honey bees also produce substrate-borne vibrations by tremulation of the abdomen, which is thought to be a motivating signal to modulate behavior in hive mates who could be contributing more effort [9]. In this issue of *Current Biology* a new context in which thoracic vibrations play a role in solitary bees is investigated [10].

Red mason bees (*Osmia bicornis* Linnaeus 1758) are solitary bees in the family Megachilidae. Two subspecies are found in Europe, *O. bicornis rufa* was collected from Germany and *O. bicornis cornigera* from England. Sympatric populations of these subspecies were found in Denmark. While males appear to be attracted to all females of the species, females in the laboratory prefer to mate with males collected from their same region, suggesting an early stage in speciation driven by female mate choice.

In male red mason bees thoracic vibrations are produced as part of a pre-copulation courtship behavior during which a male is perched on the female's back, vibrating, rubbing himself against her, and stroking her antennae and eyes with his own antennae and forelimbs. Thoracic vibrations have been identified as at least one of the criteria used by choosy female red mason bees, which mate with males that vibrate for the longest period of time [11]. Males with higher fitness could sustain production of thoracic vibrations for a longer period of time, since the flight muscle contractions are energetically expensive. Since females also prefer to mate with males from their own geographic region, male vibrations may encode more information than simply an indicator of fitness. This paper uses a unique manipulation to tease out the role of male thoracic vibrations in female choice.

Males of the red mason bee with a magnet fitted to their thorax will behave otherwise normally and pursue matings with available females. A signal made from a recording of male thoracic

vibrations can be sent through the electromagnetic field of an inductor (on which the male is perched, perhaps on a female's back) to the magnet on a male's thorax. The male thus can be manipulated to transfer vibrations other than his own to the substrate while exhibiting typical individual behavior. This means that the substrate-borne vibrations can serve as the experimental variable while all other visual and chemical cues of the male's natural characteristics are unaffected.

This 'bioassay' has revealed that the thoracic vibrations alone can elicit matings from a female that would otherwise be expected to reject a male. Females prefer males from their own region. English females typically accept English males but reject German males. German females typically accept German males but reject English males. However, English males with induced vibrational signals from a German male are accepted by German females to a statistically significant degree. German males with vibrational signals of an English male are accepted by English females, but rejected by German females. Thus, the thoracic vibrations of an appropriate male are sufficient to elicit mating even when the male's appearance, behavior and smell, and perhaps other qualities, are typical of an inappropriate mate.

This study confirms that substrate-borne vibrations alone, in this case a form of tremulation produced by contracting flight muscles without wing fanning, can elicit female acceptance of a mate in the red mason bee. While visual and chemical cues may still be used in multi-modal signaling, the essential stimulus required to ensure female choice is found in the thoracic vibrations.

What is the primary role of thoracic vibrations in the red mason bee? Is it a quantifiable measure of male fitness that females can use in assessment and choice of potential mates, or is it important as a species-specific signal that allows females to preferentially select members of their own sub-species? Thoracic vibrations could perhaps play both roles. This study is a provocative early step in finding those answers, and it provides a unique and valuable assay through the use of magnets to manipulate signals in otherwise unrestrained males.

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## Palaeobiology: Ecological Revelations in Ediacaran Reproduction

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**The biology of Ediacaran organisms — the oldest fossils of large multicellular life — has been notoriously hard to decipher, as they show little obvious relation to extant life forms. Ecological analyses, rather than anatomy, yield new revelations about their reproduction.**

Placing fossil organisms in the tree of life can be tricky. Deciphering the progress of evolution from the rock record relies on

palaeontologists correctly interpreting fossil anatomy and understanding how organs, tissues, and appendages

functioned in the living organism. Fortunately, we typically have the living relatives of these long-dead organisms for